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EXAMINER	
CUNNINGHAM, GREGORY F	
ART UNIT	**PAPER NUMBER**
2624	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/691,556	MAIDA ET AL.	
	Examiner	Art Unit	
	Greg F. Cunningham	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to communications of application received 10/24/2003.

2. The disposition of the claims is as follows: claims 1 - 11 are pending in the application. Claim 1 is the only independent claim.

3. The group and/or Art Unit location of your application has changed. To aid in the correlation of any papers for this application, all further correspondence should be directed to Group Art Unit 2624 (effective 03/07). Please be sure to use the most current art unit number on all correspondence to help us route your case and respond to you in a timely fashion.

4. When making claim amendments, the applicant is encouraged to consider the references in their entireties, including those portions that have not been cited by the examiner and their equivalents as they may most broadly and appropriately apply to any particular anticipated claim amendments.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-3, 5 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Honda et al., (US 6,249,598 B1), hereinafter Honda.

A. Honda anticipates claim 1, "A characteristic amount calculating device for soldering inspection, comprising:

design information inputting means for inputting design information of an inspection object [col. 3, ln. 62 at '115 a tested-object design dimension estimating means"];

inspection standard inputting means for inputting an inspection standard [col. 1, lns. 23-27 at 'a failure is determined if the characterizing amounts detected from an object under testing during a test deviate from the mean value of the previously derived characterizing amounts of the non-defective boards by a predetermined amount.' and col. 2, lns. 11-51, inter alia, 'standard shape estimating means for statistically processing the shape characterizing amounts for soldering portions'];

solder shape calculating means for calculating shape information of a solder fillet according to said design information [col. 2, lns. 27-28 at 'shape factor of a solder fillet for each soldered portion as shape characterizing amounts for the soldered portion'];

inspection image calculating means for calculating an inspection image according to said shape information of said solder fillet [col. 2, lns. 29-31 at 'the solder testing apparatus has tested-object shape accumulating means for storing shape characterizing amounts of soldered portions identified by the image processing means'];

characteristic amount calculating means for calculating a characteristic amount from said inspection image [col. 2, lns. 27-37 at 'shape factor of a solder fillet for each soldered portion as shape characterizing amounts for the soldered portion, and the solder testing apparatus has tested-object shape accumulating means for storing shape characterizing amounts of soldered portions identified by the image processing means, tested-object standard shape estimating

means for statistically processing the shape characterizing amounts for soldered portions, accumulated in the tested-object shape accumulating means for each model, to identify, from the stored shape characterizing amounts for soldered portions'];

solder shape defective/nondefective determining means for determining whether the solder shape is defective or nondefective from said shape information by using said inspection standard [col. 2, lns. 19-23 at 'defect determining parameters used for determining whether the soldered portion is good or bad, and defect determining means for determining whether the soldered portion is good or bad from data derived from the image processing means']; and

characteristic amount outputting means for displaying or outputting said characteristic amount and a result of defective/nondefective determination [col. 2, lns. 58-64 at 'At the time the detection has been terminated for a complete board or a plurality of boards, a histogram for detected shapes is derived for each type of lead or pad, and values presenting maximum frequencies are determined to be standard shape characterizing amounts for actual shapes of a lead or a pad and of a solder fillet.' and col. 5, lns. 57-65 at '306 illustrates a histogram of lead heights detected for components of the same type mounted on all printed circuit boards. While the occurrence of failures such as 304 or 305 causes a detected height to be higher or lower than the lead thickness, it is generally known that a failure occurring ratio in actual manufacturing sites is at most 1% or less, so that the peak of the histogram 306 indicates the lead thickness. Alternatively, a mean value of lead thicknesses may be used instead of the histogram of the peak.']" [as detailed].

B. Honda anticipates claim 2, "A characteristic amount calculating device according to claim 1, wherein said design information includes a component shape and a land shape, and said

solder shape calculating means calculates a plurality of solder shape data according to said component shape and said land shape input [col. 2, lns. 37-38 at 'shape characterizing amounts corresponding to shape factors of leads and pads and shape factors of defective solder', wherein 'leads and pads' correspond to "component shale" and "land shape" respectively.]" supra for claim 1 and [as detailed].

C. Honda anticipates claim 3, "A characteristic amount calculating device according to claim 1, wherein said design information includes a component mounting position [col. 5, lns. 9-20 at 'When lift is equal to or more than a constant threshold value, the lead is detected as lift failure. Also, a lead "misplacement" is calculated as follows, based on the side edges le of the lead and the side edge pe of the pad:

(2) misplacement=.vertline.le-pe.vertline.

(11) Here, the lead is detected as misplacement failure if the lead is deviated from the pad toward the outside, and misplacement is equal to or more than a constant ratio with respect to a design width 1w of the lead stored in a test parameter.', wherein 'lead misplacement' corresponds to "component mounting position"; and col. 5, lns. 50-51 at 'height to be detected is the height of the top surface 301 of the lead with reference to the pad 302.', also corresponding with "component mounting position"], a solder wicking position [col. 9, lns. 47-55 at 'Generally, when the fillet height is sufficiently high, the wet angle is small in relation to surface tension, in which case a lead and a pad are also favorably connected because of a large amount of solder. Thus, when these two characterizing amounts are combined to make up a determination item, a false result can be reduced. Specifically, a failure is determined when the wet angle is small and the fillet height is low, and a non-defective unit is determined in other combinations', wherein

'surface tension' and 'wet angle' correspond to "wicking"], a solder spreading position [col. 2, lns. 27-28, wherein 'solder shape fillet' corresponds to "solder spreading position"], and a solder basic shape independent of design/manufacture conditions [col. 5, lns. 25-30 at 'However, in actual electronic board mounting sites, components having the same electric characteristics are generally supplied from a plurality of manufacturers, and the components having the same electric characteristics are treated completely the same irrespective of the manufacturers of the components.']; and said solder shape calculating means calculates a plurality of solder shape data according to said component mounting position [col. 2, lns. 27-28 at 'shape factor of a solder fillet for each soldered portion as shape characterizing amounts for the soldered portion'], said solder wicking position [col. 9, lns. 47-55 at 'Generally, when the fillet height is sufficiently high, the wet angle is small in relation to surface tension, in which case a lead and a pad are also favorably connected because of a large amount of solder. Thus, when these two characterizing amounts are combined to make up a determination item, a false result can be reduced. Specifically, a failure is determined when the wet angle is small and the fillet height is low, and a non-defective unit is determined in other combinations', wherein 'surface tension' and 'wet angle' correspond to "wicking"], said solder spreading position [col. 2, lns. 27-28, wherein 'solder shape fillet' corresponds to "solder spreading position"], and said solder basic shape input [col. 5, lns. 25-30 at 'However, in actual electronic board mounting sites, components having the same electric characteristics are generally supplied from a plurality of manufacturers, and the components having the same electric characteristics are treated completely the same irrespective of the manufacturers of the components.']" supra for claim 1 and [as detailed].

D. Honda anticipates claim 5, "A characteristic amount calculating device according to

claim 1, wherein said inspection image calculating means has inspection image obtaining means for obtaining said inspection image by using an inspection image obtaining function indicating the intensity [col. 8, lns. 41-52 at '906, 907 designate an image input means and a test parameter storing means, respectively, which are similar to the image input means 107 and the test parameter storing means 110 in FIG. 1. 908 designates an image processing means which detects the position of a lead and the position of a pad. When the bright-field illumination is performed, a lead and a pad, because of higher reflectivities of their surfaces, are detected righter than surrounding resist portions having a lower effectively. Stated another way, this is an approach which detects the position of an object under testing by a difference in brightness that is detected based on the difference in reflectivity.] of said inspection image with respect to the characteristic amount including the angle [col. 4, lns. 7-30 at '105 designates the slit light projector, which is capable of irradiating an object under testing through the galvanomirror 106. Slit light irradiated to an object under testing is detected by the image detector 104, and converted into a digital image in the image input means 107. A two-dimensional image, after converted to a digital image in 107, is converted into one-dimensional waveform data indicative of a height at a slit light irradiating position in the light cutting line extracting means 108. In other words, the height of the object under testing can be derived by a known light cutting method.

(5) The foregoing processing is performed while scanning a slit light irradiating position by changing the angle of the galvanomirror 106, to detect a large number of one-dimensional height waveform data which are stored in the light cutting line accumulating means 109. Brightness of the slit light at each light cutting line extracting position is also stored in 109 in

combination. In the image processing and tested-object shape detecting means 111, an image processing window is set based on pad design position data stored in the test parameter storing means 110, and image processing is performed on each light cutting line within the image processing window to detect the shape of the object under testing.'] or thickness [col. 2, ln. 65 – col. 3, ln. 9 at 'The image processing parameters and the defect determining parameters are updated in test data updating means based on the above-mentioned standard shape characterizing amounts. Since test data are constantly updated, irrespective of before the test or during the test, based on standard shape characterizing amounts for the shapes and dimensions of leads and pads and for solder fillets derived from actually detected images, it is possible to conduct the test using the most appropriate test data for components under test even if model numbers of mounted components have been changed in the middle while a plurality of boards of the same type are being tested in succession.'] of said solder fillet" supra for claim 1 and [as detailed].

E. Honda anticipates claim 6, "A characteristic amount calculating device according to claim 5, wherein said inspection image obtaining function is calculated by using an actual inspection image of a solder fillet [col. 2, lns. 27-28 at 'shape factor of a solder fillet for each soldered portion as shape characterizing amounts for the soldered portion' and col. 2, lns. 3-8 at 'It is an object of the present invention to realize a highly reliable test by setting image processing parameters and failure determining parameters based on actual shapes and dimensions of electrode portions (leads) and pads of electronic components mounted on printed circuit boards under testing.'] formed on a land at an unmounted portion as a function showing the intensity [col. 8, lns. 41-52 at '906, 907 designate an image input means and a test parameter storing means, respectively, which are similar to the image input means 107 and the test

parameter storing means 110 in FIG. 1. 908 designates an image processing means which detects the position of a lead and the position of a pad. When the bright-field illumination is performed, a lead and a pad, because of higher reflectivities of their surfaces, are detected righter than surrounding resist portions having a lower effectively. Stated another way, this is an approach which detects the position of an object under testing by a difference in brightness that is detected based on the difference in reflectivity.] of said inspection image with respect to the characteristic amount including the angle [col. 4, lns. 7-30 at '105 designates the slit light projector, which is capable of irradiating an object under testing through the galvanomirror 106. Slit light irradiated to an object under testing is detected by the image detector 104, and converted into a digital image in the image input means 107. A two-dimensional image, after converted to a digital image in 107, is converted into one-dimensional waveform data indicative of a height at a slit light irradiating position in the light cutting line extracting means 108. In other words, the height of the object under testing can be derived by a known light cutting method.

(5) The foregoing processing is performed while scanning a slit light irradiating position by changing the angle of the galvanomirror 106, to detect a large number of one-dimensional height waveform data which are stored in the light cutting line accumulating means 109. Brightness of the slit light at each light cutting line extracting position is also stored in 109 in combination. In the image processing and tested-object shape detecting means 111, an image processing window is set based on pad design position data stored in the test parameter storing means 110, and image processing is performed on each light cutting line within the image processing window to detect the shape of the object under testing.'] or thickness [col. 2, ln. 65 –

col. 3, ln. 9 at 'The image processing parameters and the defect determining parameters are updated in test data updating means based on the above-mentioned standard shape characterizing amounts. Since test data are constantly updated, irrespective of before the test or during the test, based on standard shape characterizing amounts for the shapes and dimensions of leads and pads and for solder fillets derived from actually detected images, it is possible to conduct the test using the most appropriate test data for components under test even if model numbers of mounted components have been changed in the middle while a plurality of boards of the same type are being tested in succession.'] of said solder fillet" supra for claim 5 and [as detailed].

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Honda as applied to claim 1 above, and further in view of Sanderson et al., (US 4,876,455), hereinafter Sanderson.

A. Honda discloses claim 4, "A characteristic amount calculating device according to claim 1, wherein said solder shape calculating means calculates three-dimensional coordinate data by using a fillet curve showing the contour of said solder fillet, a wicking curve showing a solder wicking condition on a component surface, and a spreading curve showing a solder spreading condition on a land surface" supra for claim 1.

However, Honda does not appear to disclose "wherein said solder shape calculating means calculates three-dimensional coordinate data by using a fillet curve showing the contour of said solder fillet, a wicking curve showing a solder wicking condition on a component surface, and a spreading curve showing a solder spreading condition on a land surface" with regard to said curve, but Sanderson does in col. 2, lns. 61-68 at 'Utilizing the intensity values from the light responsive transducer array, a binary grid map is generated for the reflections from each point light source. Using known surface features of solder joints along with curve fitting techniques, a series of grid maps may be mathematically interpreted to reconstruct the solder joint surface. A rule-based system, through comparison with acceptable solder joint surface features, evaluates and classifies the joint for an acceptability determination.' and

col. 3, lns. 38-60 at 'First, as it turns out, the surface of a solder joint is specular, that is, having a surface that ideally reflects light only at an angle of reflection equal to the angle of incidence. Consequently for highly specular surfaces such as solder joints, a bright spot of detectable intensity can be seen on the surface only if the viewing angle is the angle of reflection. This surface is contrasted to a Lambertian surface which appears equally bright from all viewing directions and reflects all incident light. A typical example of a specular surface would be a surface plated with chrome while an example of a Lambertian surface would be the surface of a piece of tissue paper. Second the features of acceptable and unacceptable solder joints are well known. This is important not only because the solder joint quality may be determined by the joint shape but also because to determine the shape of a solder joint, it is not necessary to examine the entire surface of the joint. Only enough data points are required so that critical features of the joint are revealed. Curve fitting techniques coupled with knowledge of solder

joint profiles may be used to adequately overcome a deficiency that may be caused by a lack of data points.']

9. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Honda as applied to claim 1 above, and further in view of Keller et al., (US 3,665,367), hereinafter Keller.

A. Honda discloses claim 7, "A characteristic amount calculating device according to claim 1, wherein said inspection standard includes a solder amount standard, a solder wicking standard, and a solder spreading standard" supra for claim 1.

However, Honda does not appear to disclose "wherein said inspection standard [Keller - col. 5, lns. 14-17 & 30-38] includes a solder amount [Keller - col. 3, lns. 61-66; col. 5, lns. 10-15] standard, a solder wicking [Keller - col. 5, lns. 18-23 & lns. 27-30] standard, and a solder spreading [Keller - col. 2, ln. 65 – col. 3, ln. 5; col. 3, lns. 40-45; wherein 'flow' corresponds to "spreading"] standard ", but Keller does [Keller - as detailed] supra.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply solder testing apparatus disclosed by Honda in combination with inspection standard according to amount, flow and wicking disclosed by Keller, and motivated to combine the teachings because it would 'be an efficient and time saving method of inspection which could be accomplished efficiently, rapidly and without destruction of the terminal' as revealed by Keller in col. 2, lines 23-26.

10. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Honda as applied to claim 1 above, further in view of Keller et al., (US 3,665,367), hereinafter Keller, and further in view of Reiser, (US 5,064,291).

A. Honda and Keller disclose claim 8, "A characteristic amount calculating device according to claim 7, wherein said solder shape defective/nondefective determining means performs the defective/nondefective determination for a virtual solder shape by using said inspection standard specifying a defective range on a solder amount or a solder wetting amount" supra for claim 7.

However, Honda and Keller do not appear to disclose "wherein said solder shape defective/nondefective determining means [Reiser – abstract at 'Inspection of solder joints utilizing ilumination, reflected light intensity measurements to determine surface heights and comparison with predetermined inspection criteria to determine the integrity of the solder joint. A solder fillet (16b) is sequentially illuminated from first and second angles and optically scanned and reflected light intensity values at incremental values of inclination are measured. The heights of the fillet wall (16d) at predetermined points and the integrity of the fillet (16b) are determined using the measured reflected light intensity values and either using real-time computation or accessing an array of predetermined incremental inclination values as a function of the reflected light intensity values. Alternatively, the ratio of the sensed reflected light intensity values at each point may be used as an input variable to a one dimensional look-up table or for real-time computation.'] performs the defective/nondefective determination for a virtual solder shape [Reiser – col. 2, lns. 6-21, particularly at 'Geometric descriptors measuring the shape of the color contours and the color level intensities of the solder joint images are used to identify each defect class' and col. 2, lns. 23-33 at 'Another three dimensional optical system is manufactured by Robotic Vision Systems, Inc., (RVSI) of Hauppauge, N.Y., under the product designation HR-2000. The apparatus uses an optical triangulation three dimensional vision method to make thousands of measurements on every solder joint. The resulting data set forms a

high resolution geometric map of the solder joint and the surrounding board and component. All data are directly measured, and no data have to be inferred to make critical decisions.', wherein 'all data are directly measured' corresponds to "virtual solder shape"] by using said inspection standard specifying a defective range [Reiser – col. 2, lns. 6-21, '… used to identify each defect class', wherein 'defect class' corresponds to "defective range"] on a solder amount or a solder wetting amount ", but Reiser does [Reiser - as detailed] supra.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply solder testing apparatus disclosed by Honda in combination with inspection standard according to amount, flow and wicking disclosed by Keller, and motivated to combine the teachings because it would 'be an efficient and time saving method of inspection which could be accomplished efficiently, rapidly and without destruction of the terminal' as revealed by Keller in col. 2, lines 23-26 and coupled with shading shape determination disclosed by Reiser and motivated to couple the teachings because it would be especially advantageous as revealed by Reiser in col. 2, lns. 55-56.

B. Honda, Keller and Reiser disclose claim 9, "A characteristic amount calculating device according to claim 1, wherein said solder shape defective/nondefective determining means classifies the defective solder shape into a plurality of ranks [Reiser – col. 2, lns. 6-21, at 'Another three dimensional optical system is described in an article entitled "A Tiered-Color Illumination Approach for Machine Inspection of Solder Joints", by D. Capson et al, IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 10, no. 3, May 1988, pp. 387-393. In this system, a tiered lighting arrangement is used to generate color contours on the solder joint for the detection and classification of defects. Each type of defect gives rise to a

characteristic pattern of color contours which are processed using binary image techniques on each color plane of the image. Geometric descriptors measuring the shape of the color contours and the color level intensities of the solder joint images are used to identify each defect class', wherein 'each defect class' corresponds to "ranks according to degree of defective"] according to the degree of defective", supra for claim 8 and [as detailed].

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply solder testing apparatus disclosed by Honda in combination with inspection standard according to amount, flow and wicking disclosed by Keller, and motivated to combine the teachings because it would 'be an efficient and time saving method of inspection which could be accomplished efficiently, rapidly and without destruction of the terminal' as revealed by Keller in col. 2, lines 23-26 and coupled with shading shape determination and defect class disclosed by Reiser and motivated to couple the teachings because it would be especially advantageous as revealed by Reiser in col. 2, lns. 55-56.

11. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Honda as applied to claim 1 above, further in view of Reiser, (US 5,064,291), and further in view of Munekata et al., (US 2003/0021718 A1), hereinafter Munekata.

A. Honda discloses claim 10, "A characteristic amount calculating device according to claim 1, wherein said characteristic amount outputting means outputs information selected from the group consisting of a solder shape, solder amount, wetting amount, and inspection image shown by three-dimensional coordinate data, in addition to said characteristic amount and said defective/nondefective determination result" supra for claim 1.

However, Honda does not appear to disclose "wherein said characteristic amount outputting means outputs information selected from the group consisting of a solder shape [Honda - col. 2, lns. 27-37 at 'shape factor of a solder fillet for each soldered portion as shape characterizing amounts for the soldered portion, and the solder testing apparatus has tested-object shape accumulating means for storing shape characterizing amounts of soldered portions identified by the image processing means, tested-object standard shape estimating means for statistically processing the shape characterizing amounts for soldered portions, accumulated in the tested-object shape accumulating means for each model, to identify, from the stored shape characterizing amounts for soldered portions'], solder amount [Honda - col. 2, lns. 27-28 at 'shape factor of a solder fillet for each soldered portion as shape characterizing amounts for the soldered portion' & col. 2, lns. 29-31 at 'the solder testing apparatus has tested-object shape accumulating means for storing shape characterizing amounts of soldered portions identified by the image processing means'], wetting amount [Munekata – para. 0034 at 'The wettability of each solder alloy was tested by the wetting balance test (meniscograph method) using a standard testing apparatus for the test.'], and inspection image shown by three-dimensional coordinate data [Reiser – col. 1, ln. 60 – col. 2, ln. 5 at 'Systems based on visible light and machine vision detection have also been developed. One such system is described in a paper entitled "A Three-Dimensional Approach to Automated Solder Joint Inspection", by S. Chen, in Electronic Manufacturing, Nov. 1988. The system is based on structured light, or light of a known shape or structure. It is projected onto an object, and the reflection of the light is viewed by a camera located at a fixed angle from the projector. The distortion of the reflected light from the known projected shape is used to compute the distance of every point on the object from the projector

and camera. The reconstructed three dimensional shape is processed by software programmed with predetermined inspection criteria.'], in addition to said characteristic amount and said defective/nondefective determination result". But Reiser and Munekata do [as detailed].

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply solder testing apparatus disclosed by Honda in combination with three-dimensional approach disclosed by Reiser and motivated to combine the teachings because it would be especially advantageous as revealed by Reiser in col. 2, lns. 55-56, and further coupled with solder wetting as revealed by Munekata and motivated to couple because it would 'improve the mechanical strength or lower the melting point of the solder in an amount which does not have a significant adverse effect on other properties of the solder' as revealed by Munekata in para. [0018].

12. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Honda as applied to claim 1 above, and further in view of Bushroe, (US 5,164,994).

A. Honda discloses claim 11, "A characteristic amount calculating device according to claim 1, wherein said characteristic amount outputting means specifies a threshold related to said characteristic amount to thereby display a solder shape determined as undertight or overtight" supra for claim 1.

However, Honda does not appear to disclose "wherein said characteristic amount outputting means specifies a threshold related to said characteristic amount to thereby display a solder shape determined as undertight or overtight", but Bushroe does in col. 2, lns. 27-49 at 'To further improve the ability to recognize desired features, in accordance with a second embodiment of the present invention, there is provided a means for adaptively setting the

threshold for each window that is analyzed. This is done by providing a means for measuring the intensity of a solder strip of known thickness in the image. The system then can set a threshold that is equal to this measured intensity of the solder strip. The system further measures the intensity of several pixels in the vicinity of the center pixel and determine the darkest of these pixels. The system then will determine if this darkest pixel is lighter than the previously set threshold. If it is, the system stops because this would mean that the feature falls outside the acceptable range. For example, this could mean a defective solder joint. On the other hand, if the darkest pixel is not lighter than the threshold, then a new threshold is set that is equal to the value of this darkest pixel plus a predefined margin. As a result, the threshold used by the system is adapted for each window to be closely calibrated to the particular intensity of the feature to be analyzed. In this way, there is less likelihood of the system mistakenly identifying a nonfeature as a feature.'] Wherein 'pixel shade associated with adaptive threshold' corresponds to "threshold" associated with "undertight or overtight".

See Applicant's specification on pages 3-4 at:

"In general, the inspection image indicating the characteristic of the three-dimensional solder shape reflects a difference in solder shape between a defective and a nondefective, and therefore has different characteristics between the defective and the nondefective. Accordingly, the inspection is performed by measuring different characteristic amounts between the defective and the nondefective and providing a threshold there between to perform defective/nondefective determination. The characteristic amount means an intensity average in an arbitrary region of the inspection image or the length or area of a region having an arbitrary intensity. There is a large difference in characteristic amount between the defective and the nondefective in terms of a

general solder shape. Accordingly, by setting the threshold between the characteristic amount of the defective and the characteristic amount of the nondefective, the inspection can be performed. However, there are variations in solder shape generated, so that the characteristic amount of the defective may be similar to the characteristic amount of the nondefective in some case.

In this case, there is a possibility of "overtight" determination such that an actual nondefective solder shape is erroneously determined as defective or "undertight" determination such that an actual defective solder shape is erroneously determined as nondefective, depending upon the threshold set above. The "overtight" determination causes an increase in number of times of visual inspection to be performed in the subsequent step, and the "undertight" determination further causes a reduction in nonadjusted ratio in the subsequent step, causing an increase in cost of the subsequent step. It is therefore desirable to minimize the "overtight" determination and the "undertight" determination by adjustment of the threshold or adjustment of inspection data including modification of an inspection region or modification of an inspection method."

Thus there is concern with the threshold setting, moreover a threshold margin to reduce false defects not unlike Bushroe's 'In this way, there is less likelihood of the system mistakenly identifying a nonfeature as a feature.'

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply solder testing apparatus disclosed by Honda in combination with threshold margin disclosed by Bushroe, and motivated to combine the teachings because it would 'improve the accuracy of automatic testing systems' as revealed by Bushroe in col. 1, ln. 63 – col. 2, ln. 6.

Responses

13. Responses to this action should be mailed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Inquiries

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory F. Cunningham whose telephone number is (571) 272-7784.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt Bella can be reached on (571) 272-7778. The Central FAX Number for the organization where this application or proceeding is assigned is **571-273-8300**.

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G. F. Cunningham

Gregory F. Cunningham
Examiner, Art Unit 2624

gfc

3/30/2007

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